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Gender representation in language: More than meets the eye

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Abstract

In this chapter, we review theoretical and empirical advances in our understanding of the way readers construct a mental representation of gender. First, we introduce the different cognitive processes at the very base of any inference and explain the different top-down and bottom-up sources of information that may or may not interact when constructing a coherent representation of gender. Second, we present some empirical research on the topic, mostly conducted on adult readers, based on English, French, German, Italian, Norwegian and Spanish. Third and finally, we consider the different implications of the work presented in terms of both fundamental advances in language and cognition as well as the effects it could have upon societal issues. Some future directions are suggested.

Keywords: Gender inferences, grammar, stereotypes, Whorfian hypothesis, mental models.

Introduction

There are many different ways to consider reading, and in turn reading comprehension. On the one hand, reading can be considered as a pastime enjoyed by many and enjoyed in many different ways but on the other hand, it can also be considered as a crucial vector of societal influences and changes. If the former has lead psycholinguists to important and interesting findings, rare have been those applying their research on reading comprehension issues that may have strong impact upon the way people perceive society. Although this chapter does not pretend to respond to the latter criticism, it nevertheless presents a rather atypical psycholinguistic research field that may have some impact that goes beyond the fundamental questions that have mostly interested text comprehension researchers.

In this chapter, we review theoretical and empirical advances in our understanding of the way readers construct a mental representation of gender. First, we introduce the different processes at the very base of any inferences and explain the different top-down and bottom-up sources of information that may or may not interact when constructing a coherent representation of gender. We explain the complex nature of gender inferences in terms of the multiple, at times conflicting, sources of information. Second, we present some empirical research on the topic, mostly conducted on adult readers, based on English, French, German, Italian, Norwegian and Spanish. Most of the empirical research presented in this chapter is fairly recent, as this topic has not yet been extensively studied. Third and finally, we consider the different implications of the work presented in terms of both fundamental advances in language and cognition as well as the effects it could have upon societal issues. Some future directions are suggested, especially in terms of ways to alleviate the different biases

associated to gender representations.

Text comprehension and inferences: Reading between the lines

When reading and comprehending a text, we are usually able to answer questions about its explicit content - about the words that appeared in the text - but we are also able to focus on information that was not necessarily explicit in the text. The latter process depends on the information that we were able to extract from it and keep in memory. A common assumption underlying text comprehension is that explicit information combined with this extracted implicit information forms what is called a *mental representation* or a *mental model* of the text (van den Broek, Young, Tzeng, & Linderholm, 1998; Graesser, Singer, & Tabasso, 1994). A mental model is composed of three levels. First, the exact words and syntax are processed at a surface level for a short period of time. Second, a textbase level includes all text propositions and elements needed for text cohesion. Third and finally, a more elaborate level conveys the situation portrayed in the text (Zwaan, Magliano, & Graesser, 1995) embracing information about people, settings, actions and events described explicitly or implicitly by the text (Garnham & Oakhill, 1996). Implicit elements derived from the text are included in readers' mental model through the process of *inference* making (McKoon & Ratcliff, 1992; Graesser et al., 1994), a process that has kept text comprehension researchers industrious in the past forty years. Several issues are still controversial and not well understood, not the least of them is the amount and nature of inferences *automatically* included in readers' mental model during reading. Before stepping into this world of controversy, let us explore one issue over which there is a relative consensus. To generate inferences, readers combine different sources of information (van den Broek et al., 1998; Gernsbacher, 1997; Graesser et al., 1994), grounded in the text (i.e., bottom-up) as well as in their previously acquired knowledge (i.e., top-down) stored in long-term memory (Kintsch,

1988; Gernsbacher, 1997). Readers therefore go beyond mere linguistic processes when comprehending text (Martins & Le Bouedec, 1998). For example, when reading the sentence *There was some ice on the pavement*, readers might infer that *it is winter* or *it is very cold*. This inference derives from the information provided in the text as well as acquired knowledge about what happens in the winter under very cold conditions. Some readers may not be aware of the information needed to generate this inference and may thus not integrate this inference, exemplifying the fact that mental representations formed by readers may greatly vary from individual to individual, and from situation to situation. Garnham (1992) further adds that in any situation it is unlikely that a situation model will be a complete representation of the world.

This apparent complexity raises one main issue: depending on the information explicitly given to readers and readers' background knowledge, a given situation model could still encompass a considerable amount of information. Not surprisingly, a great deal of energy has been directed towards understanding which inferences are generated under the constraints imposed by a limited processing capacity. A first distinction has been regularly drawn between inferences made *on-line* and those made *off-line.* Whereas off-line inferences are those made at retrieval, subsequent to reading (sometimes referred to as *strategic*), on-line inferences are made during comprehension (sometimes referred to as *automatic*), while reading (Graesser et al., 1994). One-line inferences have been central to text comprehension research and have been mostly addressed by two different classical approaches: the *constructionist* (Graesser et al., 1994) and the *minimalist* (McKoon & Ratcliff, 1992) approaches. If the latter only limits its predictions of automaticity to those inferences based on easily retrievable information from memory and those needed for local coherence (i.e., connecting adjacent text constituents), the former, based on Bartlett's (1932) *search-after-*

meaning principle, assumes a wider scope of on-line inferences, also considering those needed for global coherence (i.e., connecting most elements of the text under a global thread). Some authors have discussed the relevance of this dichotomy by arguing that even inferences predicted by the minimalist approach are based on constructive processes (Garnahm, 1992), or arguing that a simple *is* vs. *is not* drawn dichotomy does not consider the complexity of the nature of some inferences (Gygax, Tapiero & Carruzzo, 2007). Gygax et al. (2007) for example, demonstrated that *emotion inferences* (i.e., the emotion of the main protagonist) could be partially inferred, giving support to both approaches. If this debate goes beyond the scope of this chapter (the empirical findings presented in this chapter are not purposed at settling the debate), both approaches have been closely related to speculations addressing the way background knowledge may be activated to construct a mental representation of the text. On the one hand, reading processes have been regarded as *explanation-based,* driven by readers' general need to establish and maintain a certain understanding of the text (van den Broek et al., 1998; Graesser et al., 1994). Consequently, the activation of background knowledge is a top-down *active* process determined by readers' need to maintain a coherent representation of the text (i.e., the *search-after-meaning* principle). On the other hand, *memory-based* approaches suggest a more *passive* bottom-up process by which textual elements activate all associated information (by a *resonance* mechanism maybe) (Gerrig & McKoon, 1998) in readers' long-term memory. Of course, not all the activated information can be integrated in readers' mental model, hence an evaluation phase has to be implemented to ensure that the correct elements are integrated (Cook & Guéraud, 2005). The two approaches differ in the extent to which they consider bottom-up and top-down processes to be central in the construction of a coherent mental representation of the text, but they both assume that an interaction between readers' knowledge and the text exists. In cases, this

interaction could be utterly straightforward. For example, in the sentence *John blamed Bill because he spilled the milk,* the referential inference is made using knowledge about the rather unpleasant nature of spilling milk and about the specific circumstances causing somebody to blame somebody else. The inference that John and Bill *are two men* is also quite evident. The names used in the sentence are unambiguously referring to men. In other cases, however, gender representation can be much more complex to construct. Depending on the language under scrutiny, different sources of information, at times contradicting one another, can be activated.

Gender inferences: When conflicting sources of information meet

The representation of gender constitutes a particularly interesting case of a complex interaction between bottom-up and top-down processes. If inferring the gender of a character who is explicitly and unambiguously named (i.e., George, Suzanne,...) is an obvious process, such a complexity becomes apparent when the character is referred to by a *role name*. Role names are commonly defined as any names that incorporate features used to describe a person or a group of people, such as hobbies (e.g. soccer fan) or occupations (e.g. dentists, actors or students). A central issue is whether people infer the gender of the characters when reading a role name in a sentence such as:

The mechanics just had lunch

If they do so, an intuitive question would be to know which gender was integrated in their mental model, and on what basis. A primary and most important feature of role names is that they often carry stereotypical information, or more specifically, gender stereotypical information (Baudino, 2001). Those interested in the influence of stereotypes on reading comprehension have often made use of this particular feature (e.g., Carreiras, Garnham, Oakhill & Cain, 1996; Duffy & Keir, 2004; Garnham, Oakhill & Reynolds, 2002; Hardin &

Banaji, 1993; Kennison & Trofe, 2003; Oakhill, Garnham & Reynolds, 2005; Sturt, 2003). In the example above, and according to norms collected in English, French and German by Gabriel, Gygax, Sarrasin, Garnham & Oakhill (2008), *mechanics* carry a strong male stereotype. Consequently, a reasonable assumption to make, if one believes that gender inferences are processed automatically during reading, would be that readers integrate the concept of *men* in their mental model as they read the role name, or shortly after.

Carreiras, Garnham, Oakhill and Cain (1996), in their first experiment (the subsequent experiments, that we'll discuss later, were run in Spanish), actually found that not only do participants build a representation of gender during reading, but they do so by relying on stereotype information. In their first experiment, English participants had more trouble mapping anaphor-antecedent when the anaphor mismatched the gender-stereotype introduced by an antecedent role name. For example, when following the sentence *The electrician examined the light fitting,* readers took longer to read *She needed a special attachment* than *He needed a special attachment.* Others have found very similar evidence (e.g., Duffy & Keir, 2004; Kennison & Trofe, 2003; Sturt, 2003). Importantly, Oakhill, Garnham, and Reynolds (2005) found that this stereotype influence was practically impossible to erase, even when participants were given specific instruction to do so. In their study, participants were presented with different pairs of words, each constituted of a role name and a kinship term (e.g., *aunt-electrician*). Participants had to decide whether the two words could represent the same person. The authors conducted four experiments varying in the extend to which they explicitly encouraged participants to respond strategically (i.e., ignoring the stereotype that the role name may have activated). Although the authors tried to encourage participants to give strategic and stereotype-free responses, responses were still dominantly stereotype biased. This was even true when participants were given the most explicit instructions (i.e., *It*

is worth remembering that professions are not clearly marked for gender,...).

The evidence presented so far suggests that stereotypes constitute a strong factor influencing the nature of readers' mental representation of gender. One could argue that the nature of this inference, strongly influences societal factors by actually contributing to a more global maintenance of gender inequality. This is especially true in patriarchal societies, where, for example, assertive behaviours might be consistently associated to authority roles and men, and nurturing behaviours to women (e.g., Eagly, 1987). By automatically generating stereotyped gender inferences, readers nourish their beliefs and representations that men and women belong to sex-typical social roles. In turn, those stereotypes may result in expectations that, for example, a man should not take care of children and a woman should not take a leading position.

Since stereotyping is relatively universal (Cuddy, Fiske, Kwan, Glick, Demoulin, Leyens, Bond et al., 2009), there should be no reason these inferential processes to be different in other languages. However, the situation is not as clear, mainly for linguistic reasons. Some languages, such as French, German, Italian, Spanish and Norwegian, for example, are *gender marked*. There are masculine and feminine words, and these are morphologically marked. Whereas inanimate beings most often have a randomly assigned gender, meaning that their gender does neither reflect masculinity nor femininity, animate beings do not. Animate beings in the masculine form (e.g., *der Vater* in German [the father]) specifically refer to men whilst those in the feminine form refer to women (e.g., *die Mutter* in German [the mother]). Although such a grammatical rule seems plain, there are circumstances where the masculine form can be interpreted differently. In German as well as in French, for example, for nouns that denote persons, the grammatical feminine and masculine forms often only differ in their suffixes, and there are specific grammatical rules about their use: To refer

to a group of people of both sexes, to persons of unknown sex, or where the sex of the person is irrelevant, the masculine form is used and is supposed to be interpreted in a generic way (see Gygax et al., 2009, for a discussion on the sequence by which children learn these rules and the implications it may subsequently have).

Gender inferences in gender marked languages

Proponents of feminist linguistics doubt that the masculine form can be used in a way that abstracts from the gender of its referents (i.e., in a generic way) and claim that the use of the masculine evokes concepts of men, thus eliminating women as referents (e.g., Braun, 1996; Bussmann, 1995; Peyer & Wyss, 1998). There is indeed growing evidence in several gender-marked languages that the generic interpretation of the masculine is quite difficult and not readily applied, thus biasing readers' mental representation towards a male dominant one (e.g., Gabriel, Gygax, Sarrasin, Garnham, & Oakhill,., 2010; Gabriel & Mellenberg, 2004; Gygax et al., 2008; Gygax et al., 2009; Stahlberg, Braun, Irmen & Sczesny, 2007). Before reviewing some of these studies, it is worth taking a moment to clearly state the different cognitive processes that may be activated when readers encounter a role name in the masculine form.

For the sake of the argument, let us assume that readers are active processors and that reading is an active problem solving situation (e.g., Britton & Black, 1985; Graesser et al., 1994). When encountering the words *les infirmiers* [the nurses], French-speaking readers most likely, assuming that they automatically encode gender, will mentally represent the people that the words refer to. To do so, they are confronted with multiple sources of information. First, although we will discuss in depth the sequence of *source activation* later, it is reasonable to assume that the morphological mark, namely the masculine, is an initially processed buttom-up information on which readers can base their representation. Readers are

actually faced with two possible interpretations of this morphological mark. On the one hand, the masculine form can be interpreted as a specific form (i.e., referring exclusively to men), but on the other hand, it can also generically refer to both men and women. Note that we could argue that the generic interpretation can be further divided. The masculine form could be used to refer to a fifty-fifty ratio, which would truly mean *generic*, but it could also mean that there is only one man in the group (and an indefinite number of women). These different interpretations lead to a particularly complex ambiguity, as there is no clear dominant or subordinate meaning. In fact, one could argue that when no explicit information is given as to the gender associated to the role name, the generic fifty-fifty ratio interpretation should be used.

The second source of information that may be activated is the gender *stereotypicality* of the concept represented by the word. In our case, *the nurses* would very likely activate a representation of *mostly women*. In this particular example, there is a conflict between the specific interpretation of the masculine form and the stereotypicality of the role name. Readers have to decide which information should be used to construct their representation.

A third, yet much less studied, source of information (or of influence), is more broadly the cultural setting in which the reading is taking place. For example, some studies that will be described have often taken place in Switzerland, which in the latest Global Gender Gap Report (Hausmann, Tyson & Zahidi, 2007), although reaching an overall 13th in the world in terms of gender equality, was still ranked relatively badly for *economic participation and opportunity* (48th) and educational attainment (88th) demonstrating a certain level of conservatism. The extend to which this influences reading is not yet clear, but differences in the general (public) visibility of women across societies might influence the activation of women when reading role names or it might most likely have an effect on language policies.

To summarize, representing gender when reading can be considered as a true interaction between bottom-up and top-down processes, maybe more so than any other kind of inferences, and not surprisingly, research so far has consistently tried to understand the interactions between the multiple, at times conflicting, potential sources of information. Contemporary research on gender inferences comparing different languages can be traced to a study by Carreiras, Garnham, Oakhill and Cain (1996) conducted in English (as described earlier) and Spanish. In English, as mentioned earlier, participants relied on stereotypical information to construct a representation, as they had more trouble processing (i.e., reading) sentences with pronouns that mismatched the gender-stereotype introduced by a role name. In Spanish (Experiments 2-4), participants had more trouble processing role names when their morphological marking or their article mismatched their stereotype. These results clearly indicated that grammatical gender induced specific inferential processes that may interfere with stereotypical information. Based on the paradigm used by Garnham, Oakhill and Reynolds (2002), Gygax, Gabriel, Sarrasin, Oakhill & Garnham (2008) pursued this line of interlingual comparisons by contrasting three languages comparable in their stereotypes but differing in their grammatical structure: English, French and German. In their study, participants had to read pairs of sentences, one sentence after the other. In each pair, the first sentence included a role name as subject (e. g., *The spies came out of the meeting room*), and the second sentence contained explicit information about the characters' gender (e. g., *It was obvious that one of the women was really angry*). Participants had to decide whether the second sentence was a sensible continuation of the first one. The sentences were identical in the three languages (i.e., same stereotypicality), but in German and French the role names were in the masculine form, hypothetically interpretable as a generic. The results showed that in English, participants' gender representations of the role names were in line with the role

names' stereotypicality, meaning that participants responded *yes* more often when the role name's stereotypicality matched the gender of the character in the second sentence. When the role names were neutral (control condition), participants responded equally *yes* to both male and female characters. In French and German, however, the representations were equally male biased across all stereotypicality conditions. Participants responded *yes* more often when the character was a man, independently of the role name's stereotypicality. The authors concluded that, in gender-marked languages such as French and German, readers do not readily apply the rule that the masculine can be considered as a non-specific, or generic, gender marking. As such, the influence of the masculine, as a specific mark, not only overruled stereotypical information, but also the generic interpretation.

The strength of gender representation in gender marked languages

Several subsequent experiments tried to evaluate how flexible these processes were. For example, to challenge the dominance of grammatical information, Gabriel, Gygax, Sarrasin, Garnham and Oakhill (2010), in a follow-up experiment, provided readers with additional and different grammatical cues. In all languages, the priming sentences were made longer by including a clause with the pronominal referent *they*. In English, the pronoun was gender neutral, in French, the pronoun was *ils* (i.e., masculine interpretable as generic) and in German, the pronoun was *sie* (i.e., generic form but morphologically identical to the feminine singular form). Earlier research by Rothermund (1998), contrary to results from Gygax et al. (2008), actually found that in German plural determiners (i.e., *die*) and pronouns (i.e., *sie*), which are morphologically identical to the feminine singular forms, could impact upon readers' representation of gender even to the extend of reversing the bias introduced by the masculine form of the role names. In English, Gabriel et al. (2010) found similar results to those in Gygax et al. (2008). In German, adding further grammatical cues significantly

weakened the overall male bias, without erasing it though. In French, however, although not significant, the numerical trend was similar to the one in Geman (i.e., a weakened male bias). In their paper, Gabriel et al. (2010) suggested that as grammatical cues were used in the early stages of processing and stereotypical information in later stages, adding information in the sentences might simply have given readers more time to elaborate their representation of gender on stereotypical information. Although consistent with their findings, this explanation is yet controversial. Referring to the results of two eye-tracking studies in German, Irmen (2007) concluded "When cues of conceptual gender and grammatical gender were present, world knowledge on gender typicality was used in the early stages of lexical access of the anaphoric expression" (p. 449). Although not explicitly stated, Irmen (2007) suggested a sequence such that stereotypical gender information (i.e., *conceptual gender* in her terms) is used at an early stage whereas grammatical gender only comes into effect at a later processing stage.

Although the sequence of activation is yet not clear, the resulting male orientated representation induced by the masculine grammatical form is difficult to deny. Some countries such as Norway have taken this issue seriously and have made attempts at modifying policies to favour gender-neutral language. For example, the feminine suffixes have largely disappeared in Norwegian since the early 1970s (Swan, 1992). The official Norwegian guidelines emphasize a strategy of gender-neutralisation (e.g., Norsk Språkråd, 1997), by imposing the masculine form to refer to *both* men and women. The rationale behind such a drastic measure was to abrogate the *masculinity* (i.e., the specific meaning of the masculine) of the former masculine human agent names. The masculine form now also refers to a (hypothetical or specific) woman or to a group exclusively composed of women. If the gender composition of a group is of importance, a mark for each gender is used (i.e., male

politicians would be referred to as “mannlige politikere” and female politicians as “kvinnelige politikere”). With reference to role names, one could argue that Norwegian lies somewhere between semantic gender languages, such as English, which lack formal gender markings, and languages with a formal gender system, such as French, Italian or German, since Norwegian *is* still somehow gender marked. Gabriel and Gygax (2008) were interested in the impact that such a seemingly *drastic* language measure and therefore replicated Gygax et al.’s (2008) experiment in Norwegian, making sure that the role names used were comparable in gender stereotypicality. Although the Norwegian students did respond according to stereotypicality when presented with female and male stereotyped role names, their responses were still male biased when presented with neutral stereotyped role names. The specificity of the masculine form was only overruled when the role name was stereotyped. One possible interpretation given was that the gender representations in Norwegian seemed “to be overshadowed by a male bias that could be called the ‘aftertaste’ of the historical gender-marking of nouns” (p.18). This is especially interesting, as the participants of this study were all born after the implementation of the new language policy. Essentially, the Norwegian change in language policy has not yet resulted in the desired full suppression of the male bias induced by the masculine form, but there are signs of “giving way for world knowledge’s influence” when one form is consistently used to refer to both, male and female exemplars.

If Norway has attempted to implement a language change to erase the masculine bias induced by the use of the masculine (not entirely successfully though), other countries have also explicited some concern and have acted accordingly. German-speaking countries, for example, often use *gender-balancing* forms (e.g. *Jede Studentin und jeder Student* [each female and each male student]) or *gender-neutralising* forms (e.g., *Die Studierende* [the ones that are studying]). French-speaking countries, however, predominantly adhere to the

traditional use of masculine forms interpretable as generic. This is not surprising considering that the Académie Française, responsible for all regulations on the usage of the French language, took a stance in 2002 by stating that writing role names in both masculine and feminine forms was "useless" and was disruptive to normal reading (see Gygax & Gesto, 2007 for an in-depth discussion of the *disruptive* effect of gender-balancing forms). Such a statement has had several implications, one of which being that no clear regulations were implemented for the use of gender-fair language in job advertisements in newspapers (in Switzerland for example). In turn, some advertisements are written in gender-balancing forms whereas others in the masculine form only. If the latter does not necessarily mean that those who advertise positions using this format are only willing to hire men, Gygax and Gabriel (2008) examined whether the appearance of feminine forms (in adjacent advertisements for example) would render any generic interpretation of the masculine more difficult. They tested whether employing feminine forms (i.e., as in the alternatives to the masculine-only) may draw readers toward interpreting the masculine form as specific. In their first experiment, participants were presented with pairs of words, each pair comprised of a role name in the masculine plural form (e.g., *infirmiers* [nurses]), and a noun in the singular form, which unambiguously represented either a man or a woman (e.g., *father* or *mother*). Participants had to decide whether the person represented by the noun could be part of the group represented by the role name. For example, participants had to decide whether *une mère* [a mother] could be part of a group of *infirmiers* [nurses]. In the experiment, divided into two parts, participants were first presented with role names only written in the masculine form (Part I). In the second part of the experiment, participants were presented with role names sometimes in the masculine form, sometimes in the feminine form (Part II). The results showed an expected general male bias when role names were written in the masculine form, independent

of the stereotypicality of the role names (i.e., participants were more likely to respond positively when the noun represented a man), but in the second part of the experiment, in which some role names appeared in the feminine form, this bias was stronger: Participants were even less likely to respond positively when a woman character was paired with a role name written in the masculine form. The authors concluded that the mere appearance of role names in the feminine form induced a more pronounced male biased representation of gender than the one found in previous experiments. Two theoretical accounts could explain these results. First, in natural conversion, people usually assume that communicators make certain facts manifest for a purpose (Sperber & Wilson, 1986). By adopting a Gricean co-operative principle (Grice, 1967) and as both parts of the experiment were similar in nature and were run within the same session, participants may have assumed that there was a clear reason for the appearance of feminine forms. This appearance may thus have lead participants to interpret the feminine forms as a signal to consider the masculine forms as specific. Second, the appearance of feminine forms, *specifically* referring to women, may have simply automatically triggered the specific interpretation of the masculine (i.e., even more so than before) or facilitated the inhibition of the generic interpretation. The first account is pragmatic in nature, whereas the second is cognitive. The authors conducted a second experiment to investigate these two accounts. Half of the participants were presented, before the actual experimental task, with eight short job descriptions written only in the masculine form (e.g., *infirmiers* [nurses]), and half of the participants were presented with the same job descriptions written in the masculine *and* feminine form (e.g., *infirmiers ou infirmières* [male or female nurses]). These descriptions were presented as a separate experiment. Participants just read these descriptions and answered comprehension questions. The following experimental task was exactly the same as Part I of the first experiment (i.e., all role names were in the

masculine form). The two parts (job descriptions and Part I) were very different in the nature and procedure of the task and could therefore be considered as emanating from different sources of communication. The results showed that although the global male bias was still present, it was more pronounced for the group of participants who read the masculine *and* feminine job descriptions beforehand. Gygax and Gabriel (2008) concluded that the mere appearance of role names in the feminine form, regardless of the source of communication, triggered the masculine form to be interpreted as specific, inducing a stronger male bias. Overall, this study showed that when no official regulations are available and when different forms are used in parallel, the generic interpretation of the masculine becomes even more difficult.

Implications of gender inferences and their associated biases

The studies described so far showed that when processing role names, readers form a mental representation of gender based on grammatical features when these are available, and based on stereotypes when they are not. In the former case however, when readers are confronted with the masculine form, they have to choose between two different interpretations. In most cases, readers favour a specific interpretation of the masculine form, leading to a male biased representation. The implications of such a bias are numerous. For example, Chatard, Guimond, and Martinot (2005) found that when presented with job descriptions written only in the masculine form, female youngsters aged fourteen to fifteen felt less self-efficacy in their ability to undertake studies that would lead to the various jobs than when they were written in a gender balancing form. Results were actually similar for male youngsters, raising the concern that job descriptions making women more visible may simply result in job depreciation (i.e., if women can do it, anybody can). Role names written in the feminine form may activate a traditionally pejorative connoted representation of women

(Chatard et al., 2005, p. 267). The authors argued that most highly valorised professions, such as *doctor*, would doubtfully suffer from any possible depreciation. Gygax and Gesto (2007) explored the possibility that job descriptions written in a gender-balancing form would result in a significant depreciation (i.e., less wages, less physically and mentally difficult and less years of training) and found no such effect. Importantly though, all youngsters seemed less confident when the jobs portrayed were stereotypical of the other sex. This illustrate the fact that even if the bias induced by the grammatical form was to be expunged, it would not yet mean that readers build a gender-neutral, or mixed-gender representation.

Chatard et al.'s (2005) experiment demonstrated that language had an effect on one's own self-confidence. More generally, the male bias induced by the grammatical masculine form reflects the classical Sapir-Whorf hypothesis by illustrating the impact that language can have on cognition. The Sapir-Whorf hypothesis comprises two main ideas: *linguistic determinism* and *linguistic relativism.* The former refers to the idea that our thoughts are determined by the structural properties of language, whereas the latter assumes that as languages do vary, they generate different cognitive structures. If the hypothesis was initially well received and quite appealing, its focus on colour perception was to be controversial (Li & Gleitman, 2002), the effect of language on such lower perceptual processes being most likely minimal. Fairly recent research on higher cognitive processes, such as spatial representations (e.g., Landau & Jackendoff, 1993; Hayward & Tarr, 1995; Li & Gleitman, 2002; Levinson, Kita, Haun & Rasch, 2002), number (e.g., Miller & Stigler, 1987) and time processing (Boroditsky, 2001) gave the hypothesis a new perspective. As noted by Harley (2008) though, it has been surprising that only little empirical work had been conducted on the effect of language on gender representation (p.98). As a matter of fact, Harley (2008) based his comment on work by Spender (1980) and Kennison and Trofe (2003), suggesting

first that using terms such as *man* to refer to humanity implied that men were more important than women, and second that gender-stereotyped role names created strong expectations about the people who were referred to. If considering the work on grammatical cues presented in this chapter, Harley (2008) would have had an even stronger argument. The fact that grammatical features influences the way we perceive certain groups clearly supports the determinism component of the Sapir-Whorf hypothesis. What is not clear though, and this will discussed in the following section among other issues, is the extent to which the biased representations presented so far have an actual real impact upon people's behaviours (i.e., not just on cognition).

Work in progress and future directions

As different buttom-up and top-down sources of information interact to form a mental representation of gender, it is reasonable to assume that there will be individual differences in the nature and strength of gender inferences. These could be grounded in different social constructs as well as different cognitive capacities. For example, Gabriel et al. (2010) explored whether sexism beliefs, as measured by the *Modern Sexism Scale* questionnaire of Swim et al. (1995) could affect the way readers process role names, in English, French and German. Previous work in English had been equivocal, as Matheson and Kristiansen (1987) found that people holding less positive attitudes towards women perceived professional occupations with more gender-stereotyped attitudes, whereas Dunning and Sherman (1997) found no evidence of gender-stereotyping being moderated by sexist beliefs. Gabriel et al. (2010) hence formulated their hypotheses in this way: *If* sexism is associated with greater stereotyping, those holding higher sexist beliefs should be more biased by stereotyped information. In French and German, those holding higher sexist beliefs should have an attenuated grammatical influence as a result of greater stereotyping. In English, readers'

mental representation was indeed moderated by sexist beliefs, implying a strong top-down influence when reading role names. In French and German, there was no such moderation. The authors suggested two possible explanations. First, the male biased induced by the masculine form could have been too strong for moderating factors to have an effect. Second, and most likely, sexist beliefs could have had an impact on the way the masculine form was processed (and not only on stereotyped information). Those holding lower sexist beliefs may have more positive attitudes towards gender-neutral language (see Sarrasin et al., 2010 for the link between sexism and the attitude towards gender-neutral language). In turn, holding positive attitudes towards gender-neutral language could lead to different contradicting ways of processing masculine forms (Stahlberg et al., 2007). Those holding positive attitudes towards gender-neutral language could be more sensitive to potential biases and therefore more careful (i.e., interpret the masculine form as generic), but likewise they might not belief in the possibility of a generic interpretation (i.e., interpret the masculine as specific). To our knowledge, no study has yet been able to disentangle these two possibilities.

Gygax, Gabriel, Lévy, Pool, Grivel and Pedrazzini (2010) also introduced the idea that since there were two ways to interpret the masculine form (i.e., specific and generic), some inhibition processes might be at stake when generating gender inferences. In their experiment, they tested two different aspects. First, they tested whether participants could readily use the generic interpretation when explicitly asked to, and second whether participants with lower inhibition capacities, as measured by the Flanker test, would struggle more to do so (i.e., would struggle to inhibit the specific interpretation of the masculine). In their experiment, they used the same paradigm as Gygax and Gabriel (2008), presenting participants with pairs of words, each pair comprised of a role name in the masculine plural form (e.g., *infirmiers* [nurses]), and a noun in the singular form, which unambiguously represented either a man or

a woman (e.g., father or mother). Participants had to decide whether the person represented by the noun could be part of the group represented by the role name. The experiment was divided into two parts. In the first part, participants were not given any specific instructions as to how to interpret the masculine form. In the second part, participants were reminded of the generic interpretation rule. At the end of the experiment, participants performed the Flanker test. In this test, supposed to mirror inhibition capacities (Fan, McCandliss, Sommer, Raz & Posner, 2002), participants are presented with strings of five arrows appearing one after the other. For each string, participants have to focus on the middle one whilst not paying attention to the other ones and indicate in which direction the arrow goes. The four distractor arrows could go in the same direction, or in opposite direction to the target arrow. An additional neutral condition shows four distractor lines instead of arrows. Participants with higher inhibition processes usually respond faster to the target arrows when imbedded in a string with opposite direction distractor arrows. Gygax et al. (2010) found an interesting pattern of results. Although participants' actual responses to the experimental task hinted that they managed to encompass a generic interpretation of the masculine form after being instructed to do so, participants' *response times* indicated that there was still a trace of a specific interpretation (i.e., positive responses were always slower for female characters). These results were on the whole independent of inhibition capacities and hence suggest that a specific interpretation of the masculine form is strong inasmuch that it is impossible to completely inhibit it, even for those who have high inhibition capacities.

As mentioned earlier, another issue that is still under investigation and that promises to be challenging is the sequence of activation of the different sources of information. One possibility, mostly supported by Irmen and her colleagues is that, in gender marked languages, stereotype information is initially activated and subsequently overridden by

grammatical cues. In a very recent study, Irmen, Holt, and Weissbrod (2010) presented for the first time ERP evidence associated to both grammatical and stereotypical cues. They actually found evidence that both types of information were early activated in parallel (i.e., semantic effect at N400 for both types) and interactive processes were apparent later (i.e., at P600). In essence, Irmen et al. (2010) now suggest that both information are first processed in parallel, and then interact in the construction of a representation of gender. In terms of *word processing*, early influence of stereotype information could make sense, as morphological grammatical features are usually at the end of the word. However, in terms of ease of activation, it seems a little counterintuitive. Stereotype information is elaborative in nature, whereas, at least for its specific meaning, the masculine form is a text-based surface information which meaning may be more easily activated. When reading text, it has actually been suggested that more simple and underspecified representations are perfectly adequate and sufficient (e.g., Ferreira, Bailey, & Ferraro, 2002; Gygax, *in press*; Sanford & Graesser, 2006). A representation based on surface information is probably more economical in terms of the information to activate. This is consistent with findings from Gabriel et al. (2010), as well as the ones from Cacciari and Padovani (2007), who found evidence of gender stereotype priming in Italian only when the prime-target intervals and the presentation of the primes were prolonged (Experiment 2). However, both studies were not directly investigating the sequence of activation of *grammar vs. stereotypes*.

As a final word, we believe that this is an exciting field of research, as it implicates both cognitive and social concepts. On a cognitive level, research so far has shown that an early-learned grammatical rule such as the specific meaning of the masculine form may well be difficult, or even impossible to inhibit, even when opposing rules should be applied. The direct result of this processing difficulty is that in gender-marked languages, the

representation of gender that readers build is most often biased towards a male representation. When it is not, or in non gender-marked languages, it is based on stereotypes. Actually, and this is crucial, both sources of information may have negative impact upon society, as one creates a representation of the world mostly composed of men, and as the other creates a representation of the world based on determined roles. Still, as a fairly young topic, there are a lot of issues that has not received much attention. For example, there has been very little on the impact of biased representation of gender upon *decision making* (e.g., when reading job descriptions, when choosing a professional career, etc.). This could be a crucial issue, especially considering the limited opportunities that women already have in patriarchal environments. Another domain that is yet to flourish is the understanding of the processes involved when switching from one language to another. Less proficient bilinguals may have their representations in L2 polluted by L1, although both may refer to gender differently (stereotypically *and/or* grammatically). In addition to this, bilinguals may have been educated in different cultures, each characterised by different collective attitudes towards gender equality.

In all, this topic presents a promising area for those interested in the interactive nature of top-down and bottom-up processes when building a coherent representation of the world. If the interaction between the environment and background knowledge is often activated in cognitive processes, gender representation is most particular, as it may also include societal factors as a modulating influence. As a final word, we would like to emphasize that gender processing constitutes a relatively strong support, alongside recent evidence in spatial representation in particular (e.g., Levinson et al., 2002), to the Sapir-Whorf hypothesis: grammatical gender marks (and in cases activated stereotypical information) induce specific mental representations of men and women, even in cases where they are meant to be ignored.

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